are approximately correct. The solar distance of the arc at 1 p. m. was measured at 46½°, while the altitude of the sun at the same hour two days later was 66°. The sun's altitude at the moment considered must have been between 68° and 63°, where, according to the theory of Bravais, the solar distance of this arc should be between 46° and 47°. (See "Different forms of Halos and their Observation," MONTHLY WEATHER REVIEW, July, 1914.)

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THE BLUE OF THE SKY AND AVOGADRO'S CONSTANT.[1]

By D. PACINI.

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Rayleigh's theory attributes the blue of the sky to molecular dispersion; but we have also to do with dust and with molecular agglomerations (on ions, on uncharged nuclei produced by the action of ultra-violet light on oxygen, or on water vapor) which are larger in size than the dimensions required by Rayleigh's theory, but which vary in size and number. The author has studied observed departures from the inverse fourth-power law, and tabulated the calculated value of n in λ^{-n}. It is mostly numerically smaller than 4, but has been found as large as 7. The observations are reduced to a series of typical curves, less or more in disaccord with the theoretical curve, and the probable causes of these discrepancies are considered. A perfect atmosphere would give data corresponding to about 62×10^{22} molecules per gram-molecule; the author finds his observations lead to a value of 57×10^{22}. Dember found by analogous methods 28, Abbot and Fowle 52, and King 62.3, $\times10^{22}$. On the whole, this is sufficient to show that the blue of the sky is mainly due to molecular dispersion.—*A. D[aniell]*.

PHOTOGRAPHY OF ZODIACAL LIGHT AND COUNTERGLOW.[2]

By A. E. DOUGLASS.

[*Reprinted from* Science Abstracts, Sect. A, Apr. 25, 1916, § 424.]

Successful photographs of these phenomena of very slight contrast, were obtained by careful consideration of the conditions to give even illumination and intensification of photographic contrast. A camera lens of very large relative aperture was used (diameter 1 inch, focal length 2 inches), with exposures varying from 8 to 20 minutes. Equally good results were obtained with orthochromatic and ordinary plates, and it was found best to develop with hydroquinone bromide, kept cool, arranged for prolonged development. Evenness of illumination was got by using a special form of panoramic camera, with a focal diaphragm 17 mm. wide, the lens rotating at the rate of 2° per minute. The instrument was provided with three exactly similar lenses rotated by the same clock, so that three negatives were produced for each exposure. For producing positives, these negatives were put together and the copy taken through the combined pictures, thus increasing the contrast values given by a single film.

In the discussion of the paper the question was raised whether it might not be better to make a series of positives from each negative and superpose these for the increase of contrast instead of the negatives; also the importance in such work of attending to the perfect cleanliness of the lens surfaces, elimination of lens or camera glare, danger of diffraction with small apertures, etc.—*C. P. B[utler]*.

PROPAGATION OF SOUND IN THE ATMOSPHERE.[3]

By E. VAN EVERDINGEN.

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In various investigations on the propagation over great distances of sounds from intense sources, specially in the case of volcanic eruptions and explosions, deviations have been found, partly regular, partly irregular. The source of sound is always surrounded by an area of regular or irregular shape, where the sound is heard everywhere, but the source is far from being always situated symmetrically within this area, and the dimensions of the latter are not even in the first place determined by the intensity of the sound. In many cases a second area of audibility occurs, separated from the first by a region where no sound at all is heard. Sometimes this second area partly surrounds the first; sometimes it consists only of isolated spots. It can be said generally that the smallest distance from the source of sound for this second area is usually much more than 100 kilometers and that the intensity of sound at this smallest distance is no less than at the outer border of the first area of audibility, which is much nearer to the source of sound. These facts are illustrated by diagrams of seven different cases which have previously been investigated. These are as follows: (1) Explosion of 15,000 kilograms of dynamite at Farde, in Westphalen, December 14, 1903 [G. von der Borne, Abs. 106 (1911)]; (2) explosion of 25,000 kilograms of dynamite near the Jungfrau Railway November 15, 1908 (A. de Quervain); (3) three eruptions of the volcano Asama in Japan on December 7, 1900, December 25, 1910, and April 4, 1911 (F. Fujiwhara); (4) explosion of gunpowder and dynamite at Kobe April 3, 1910 (S. Fujiwhara); (5) explosion of 200,000 kilograms of gunpowder in a magazine at Wiener-Neustadt on June 7, 1912 [J. N. Dörr, Abs. 1295 (1914)].

Two chief lines have been followed in the endeavor to explain these facts. The first way, now quite old, ascribes the abnormal propagation of sound to the influence of variations in temperature and wind velocity in the superposed layers of air in the atmosphere. It is easy to see how, by certain suppositions about the vertical distribution of wind velocity, the peculiarities of the propagation of sound, specially the silent region, may be explained. The influence of temperature, which decreases upward, is a decrease of the velocity of sound in the higher regions, thus causing the sound rays to curve upward from the earth. A horizontal wind in the direction of the sound, and with higher velocities at higher levels, may counteract the above temperature effect and overcome it, so turning the rays down again to the earth. A silent region followed by a second audible area is thus accounted for.

The second and entirely different line of thought was put forward by Von der Borne. He supposes that the appearance of silent regions, in some cases at least, may be due to the change in composition of the atmosphere, which is caused by the unequal decrease of the partial pressures of the constituents of the atmosphere. If no mixing by convection currents occurred, each of the gaseous constituents of the atmosphere would form an atmosphere entirely according to its own laws. In consequence

[1] Nuovo cimento, July-Aug., 1915, 10:131-167.
[2] Phot. jour., Feb. 1916, 56:44-47; discussion, 47-48.
[3] Proc., K. Acad. Amsterdam, 1916, 6, 18:933-960.